

CLAIMS

What is claimed is:

1. A method of installing a conduit in a hole in the earth, comprising the steps of:
 - (a) placing the conduit in at least one hole in the earth;
 - (b) mixing a grout composition with water to form a grout slurry having a thermal conductivity greater than about 1.4 Btu/hr-ft-°F; and
 - (c) placing the grout slurry in the hole adjacent to the conduit.
2. The method of claim 1, wherein the grout composition comprises calcium bentonite present in an amount of from about 15% to about 45%, sodium bentonite present in an amount of from about 15% to about 45%, a silica material present in an amount of from about 10% to about 35%, and a carbon source present in an amount of from about 10% to about 75%, all by weight of the grout composition.
3. The method of claim 1, wherein the grout composition is a one-sack product.
4. The method of claim 1, wherein the conduit comprises a heat transfer loop for transferring heat between the earth and a heat transfer fluid flowing through the loop.
5. The method of claim 1, wherein the conduit comprises a grounding rod.
6. The method of claim 2, wherein the sodium bentonite has a 30-mesh particle size.
7. The method of claim 2, wherein the grout composition further comprises from about 0% to about 2% of an alkaline earth metal oxide by weight of the grout composition.
8. The method of claim 7, wherein the alkaline earth metal oxide comprises magnesium oxide.
9. The method of claim 2, wherein the silica material comprises silica flour.
10. The method of claim 2, wherein the carbon source comprises flaked graphite.

11. The method of claim 1, wherein the grout composition comprises from about 2% to about 10% of a dispersant by weight of the grout composition.
12. The method of claim 11, wherein the dispersant comprises ammonium lignosulfonate salt, a metal lignosulfonate salt, a phosphate, a polyphosphate, an organophosphate, a phosphonate, a tannin, leonardite, a polyacrylate having a molecular weight greater than about 10,000, or combinations thereof.
13. The method of claim 11, wherein the dispersant comprises sodium acid pyrophosphate.
14. The method of claim 1, wherein an amount of the grout composition present in the grout slurry is in a range of from about 35 % to about 45 % by weight of the grout slurry.
15. The method of claim 1, wherein the grout slurry has a thermal conductivity greater than about 1.5 Btu/hr-ft-°F.
16. The method of claim 1, wherein the grout slurry has a thermal conductivity greater than about 1.6 Btu/hr-ft-°F.
17. The method of claim 1, wherein the grout slurry has a hydraulic conductivity of from about 5×10^{-9} cm/s to about 1×10^{-8} cm/s.
18. The method of claim 1, wherein the grout composition comprises calcium bentonite present in an amount of from about 15% to about 20%, sodium bentonite present in an amount of from about 15% to about 20%, a silica material present in an amount of from about 10% to about 20%, a carbon source present in an amount of from about 40% to about 50%, an alkaline earth metal oxide present in an amount of from about 0.5% to about 1%, a dispersant present in an amount of from about 4% to about 7%, all by weight of the grout composition.

19. The method of claim 1, wherein the grout slurry has a viscosity of less than about 600 cp when an amount of the grout composition present in the grout slurry is less than or equal to about 40% by weight of the grout slurry.

20. The method of claim 1, wherein the grout composition comprises calcium bentonite present in an amount of about 17.5%, sodium bentonite present in an amount of about 17.5%, silica material is present in an amount of about 14.5%, a carbon source is present in an amount of about 45%, an alkaline earth metal oxide present in an amount of about 0.5%, and a dispersant present in an amount of about 5%, all by weight of the grout composition.

21. A grout composition comprising:

(a) sodium bentonite present in an amount of from about 15% to about 45% by weight of the grout composition;

(b) calcium bentonite present in an amount of from about 15% to about 45% by weight of the grout composition;

(c) a silica material present in an amount of from about 10% to about 35% by weight of the grout composition;

(d) a carbon source present in an amount of from about 10% to about 75% by weight of the grout composition; and

(e) a dispersant present in an amount of from about 2% to about 10% by weight of the grout composition.

22. The grout composition of claim 21, being a one-sack product.

23. The grout composition of claim 21, wherein the sodium bentonite has a 30-mesh particle size.

24. The grout composition of claim 21, further comprising an alkaline earth metal oxide present in an amount of from about 0% to about 2% by weight of the grout composition.

25. The grout composition of claim 24, wherein the alkaline earth metal oxide comprises magnesium oxide.
26. The grout composition of claim 21, wherein the silica material comprises silica flour.
27. The grout composition of claim 21, wherein the carbon source comprises flaked graphite.
28. The grout composition of claim 21, wherein the dispersant comprises an ammonium lignosulfonate salt, a metal lignosulfonate salt, a phosphate, a polyphosphate, an organophosphate, a phosphonate, a tannin, a leonardite, a polyacrylate, or combinations thereof.
29. The grout composition of claim 21, wherein the dispersant comprises sodium acid pyrophosphate.
30. The grout composition of claim 21, being capable of forming a slurry having a thermal conductivity greater than or equal to about 1.3 Btu/hr-ft-°F.
31. The grout composition of claim 21, being capable of forming a slurry having a thermal conductivity greater than or equal to about 1.4 Btu/hr-ft-°F.
32. The grout composition of claim 21, being capable of forming a slurry having a thermal conductivity greater than or equal to about 1.5 Btu/hr-ft-°F.
33. The grout composition of claim 21, being capable of forming a slurry having a thermal conductivity greater than or equal to about 1.6 Btu/hr-ft-°F.
34. The grout composition of claim 21, being capable of forming a set slurry having a hydraulic conductivity of from about 5×10^{-9} cm/s to about 1×10^{-8} cm/s.
35. The grout composition of claim 21, further comprising an alkaline earth metal oxide present in an amount of from about 0.5% to about 1%, wherein the calcium bentonite is present in an amount of from about 15% to about 20%, the sodium bentonite is present in an amount of from about 15% to about 20%, the silica material is present in an amount of from about 10% to

about 20%, the dispersant is present in an amount of from about 4% to about 7%, and the carbon source is present in an amount of from about 40% to about 50%, all by weight of the grout composition.

36. The grout composition of claim 21, being capable of forming a grout slurry having a viscosity of less than about 600 cp when an amount of the grout composition present in the grout slurry is less than or equal to about 40% by weight of the grout slurry.

37. The grout composition of claim 21, being present in a grout slurry in an amount of from about 35 % to about 45 % by weight of the grout slurry.

38. The grout composition of claim 21, further comprising an alkaline earth metal oxide present in an amount of about 0.5%, wherein the calcium bentonite is present in an amount of about 17.5%, the sodium bentonite is present in an amount of about 17.5%, the silica material is present in an amount of about 14.5%, the dispersant is present in an amount of about 5%, and the carbon source is present in an amount of about 45%, all by weight of the grout composition.

39. A grout slurry having a thermal conductivity greater than about 1.4 Btu/hr-ft-°F.

40. The grout slurry of claim 39, wherein the thermal conductivity is greater than about 1.5 Btu/hr-ft-°F.

41. The grout slurry of claim 39, wherein the thermal conductivity is greater than about 1.6 Btu/hr-ft-°F.

42. The grout slurry of claim 39, having a hydraulic conductivity of from about 5×10^{-9} cm/s to about 1×10^{-8} cm/s.

43. The grout slurry of claim 39, comprising water and a grout composition present in an amount of from about 35 % to about 45 % by weight of the grout slurry.

44. The grout slurry of claim 39, comprising water and a grout composition, wherein the grout composition is a one-sack product. /

45. The grout slurry of claim 39, comprising water and a grout composition, wherein the grout composition comprises calcium bentonite present in an amount of from about 15% to about 45%, sodium bentonite present in an amount of from about 15% to about 45%, a silica material present in an amount of from about 10% to about 35%, a carbon source present in an amount of from about 10% to about 75%, an alkaline earth metal oxide present in an amount of from about 0% to about 2%, a dispersant present in an amount of from about 2% to about 10%, all by weight of the grout composition.